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ABSTRACT

This study was conducted to examine sex typing of mathematicians and scientists and to evaluate a course, "Equity Issues in a Technological Society," designed to sensitize students to gender inequities in education and to expose them to more equitable teaching strategies. Subjects were 248 entering undergraduate university students enrolled in an elementary teaching program. Of these, 127 agreed to enroll in specific courses designed to enhance equitable teaching while those remaining served as controls. All subjects completed a battery of tests at the beginning of the project including the Teaching Strategies Test (TS), developed for use in this research. The TS was administered as a pre/post test to students participating in the course as well as to the control group. Results indicate that the course was successful in increasing students' awareness of effective equitable teaching strategies and useful in preparing prospective elementary teachers to teach mathematics and science in an equitable manner. Further research is recommended, which should include the degree to which equitable teaching strategies are employed in actual practice and their impact on pupils. (Author/LL)

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Factors Related to Equitable Teaching: Implications for an Equity Issues Course

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Running Head: EQUITABLE TEACHING

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Abstract

The purpose of this study was to examine several factors thought to predict sex typing of mathematicians and scientists and to evaluate a course designed to present equitable teaching strategies to pre-service elementary teachers. Subjects were 248 prospective elementary teachers that completed the Attitudes Toward Women Scale (AWS), the Questionnaire on Men (QOM), the Bem Sex Role Inventory (BSRI), the Teaching Strategies test (TS), the Draw-a-Scientist test (DAST) and the Draw-a-Mathematician (DAMT) test. Results did not reveal any significant predictors of stereotypical beliefs, but did indicate that the equitable teaching course was successful.

Factors Related to Equitable Teaching: Implications for an Equity Issues Course.

Research has indicated that an individual's interest in mathematics and science is influenced by the images he or she holds of mathematicians and scientists (Berryman, 1983; Lawrenz and Welch, 1983; Reid and Stephens, 1985). That is, the more similar the image of the mathematician or scientist is to the self-image, the more likely the individual will be to pursue interests in mathematics and science. Frequently, individuals hold stereotypically masculine images of scientists and mathematicians (Kahle, 1986; Kelly, 1985). These images have discouraged women from pursuing mathematics and science-related careers (Berryman, 1983).

There is an obvious need to change these stereotypical images. One way to begin this change is to establish equitable teaching practices at the elementary school level. The elementary years are an extremely influential period for the formation of images of scientists and mathematicians (Chambers, 1983). However, many elementary teachers hold stereotypical images of mathematicians and scientists themselves and often do not equally encourage

participation in these disciplines (Kahle, 1988; Talton and Simpson, 1986; Parker and Rennie, 1986). Therefore, it is important to encourage non-stereotypic perceptions in prospective elementary teachers. It is also important to train them to encourage these perceptions in their future pupils.

In training elementary teachers, we must consider the factors that may be related to stereotypical perceptions of scientists and mathematicians. Researchers have shown that attitudes toward women (Foss and Slaney, 1986), beliefs about the male role in society, and gender classification (Knight and Sedlacek, 1983) influence beliefs about the appropriateness of males and females in respective non-traditional roles. Therefore, a person's gender identification (masculine, feminine, androgynous, undifferentiated), attitude towards women, and ideas about masculinity may be related to their perceptions about the appropriateness of males and females in science and math related occupations; occupations traditionally thought to be masculine. Hence, we might expect that teachers who hold particularly stereotypic views about ideal male and female roles would also tend to perceive of typical scientists and

mathematicians as being men.

This study served three purposes. The first was to examine the predictors of gender images held by prospective elementary teachers about the gender of mathematicians and scientists. The second purpose was to discover if sex-role identification was related to images held of mathematicians and scientists, attitudes towards women, and beliefs about male roles in society. The third purpose was to evaluate the effectiveness of an Equity Issues course designed to prepare prospective elementary teachers in the use of equitable instruction in mathematics and science.

Method

Subjects

Subjects were 248 entering undergraduate university students enrolled in an elementary teaching program. Of these 248, 127 agreed to enroll in specific courses and sections designed to enhance equitable teaching as a part of the National Science Foundation Elementary Mathematics/Science Project at the University of Northern Colorado (project students). The remaining subjects served as control students.

Procedure

All subjects completed the Attitudes Toward Women Scale (AWS; Spence and Helmreich, 1978), the Questionnaire on Men (QOM; Sadker & Sadker, 1982), the Bem Sex Role Inventory (BSRI; Bem, 1981), the Draw-a-Scientist Test (DAST; Chambers, 1983), a Draw-a-Mathematician Test (DAMT) (adapted from the Draw-a-Scientist-Test), and a Teaching Strategies Test (TS). The instruments were given as part of a battery of instruments administered at the beginning of the students' involvement with the research project.

The TS was administered as a post-test after project students participated in the Equity Issues course. The Equity Issues course, titled "Equity Issues in a Technological Society" was developed as a part of a model pre-service elementary mathematics/science program at the University of Northern Colorado (the project was partially funded by the National Science Foundation). The course was designed to sensitize students to gender inequities in education and to expose them to more equitable teaching strategies. Control students did not participate in this course, but were also given the TS post-test.

The TS was developed for use in this project. It assesses student's knowledge of teaching strategies that would promote equitable learning in the classroom. Respondents were asked to list as many teaching strategies as they could that would ensure the participation and learning of all their future pupils in science and mathematics. Responses that expressed an equitable teaching style (e.g., asks questions of both boys and girls, use gender-free language) received one point.

BEM scores were calculated using the median split technique suggested by Bem (1981) which produces a four category classification: undifferentiated, feminine, masculine, and androgynous.

The DAST (Chambers, 1983) measures typical images one holds about scientists and mathematicians. Subjects reveal typical beliefs about the gender and personality of scientists and mathematicians by drawing images of them. The DAMT was a modification of the DAST. Both instruments were scored according to the gender depicted of the scientist or the mathematician. Specifically, responses were coded as reflecting a male image or female image.

The QOM measures beliefs about the role of

masculinity in today's society. Measurement is on a continuum of traditional to non-traditional roles.

Results

A multiple regression analysis (stepwise procedure) was conducted to determine the best predictors of DAST and DAMT scores. Results indicate neither the QOM nor the AWS was a significant predictor of an individual's gender image of a scientist or a mathematician. Subjects who held positive attitudes towards women or that viewed masculinity in less traditional ways did not hold either a less masculine or more feminine image of a mathematician or scientist.

Analysis of variance tests (ANOVA's) between each of the gender role classifications (produced by the BSRI) and scores on the DAST, and DAMT were conducted. No significant *F*-values between these were obtained on any of the measures. Androgynous, undifferentiated, masculine, and feminine sex-role classified subjects did not hold different gender images of mathematicians or scientists.

An analysis of covariance (ANCOVA) was performed on TS post-test scores with TS pre-test scores as the covariate. Results revealed a significant difference

between project and control groups, $F(1,233)=67.08$, $p<.001$. Project students were able identify more equitable teaching strategies than control students.

Discussion

The equitable teaching course was successful in increasing students awareness of effective equitable teaching strategies. These results support findings from a qualitative study (i.e. interviewing students about their understanding of equity issues in education) conducted for the same course (Constas, McDevitt & Gardner, 1991; Gardner, McDevitt & Constas, 1990). These findings are important because they suggest that this course is useful in preparing prospective elementary teachers to effectively teach mathematics and science in an equitable manner. Longitudinal research is needed to determine the degree to which they will employ the equitable teaching strategies and have an impact on their pupils.

Attitudes towards women and beliefs about the masculine role were not significant predictors of students' allocation of gender to images of mathematicians or scientists. Perhaps the DAST and DAMT measure the individual's experience with role

models in mathematics and science, while the AWS and the QOM measure beliefs about appropriate gender roles more generally.

Similarly there were no significant differences in the gender portrayed in the images of mathematicians or scientists between students with feminine, masculine, androgynous and undifferentiated sex-role identifications. These results do not support previous research that found individuals with an androgynous orientation to be more likely to view women in non-traditional occupations than individuals with masculine, feminine, or undifferentiated orientations (Knight and Sedlacek, 1983). Consequently, it would be valuable for future researchers to investigate other origins of gender-typing of scientific and mathematical professions. We recommend that these investigations include multiple measures of the degree to which individuals sex type professions. One limitation of the present study was that single drawings were included as measures of this tendency.

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